



Camp Edwards Massachusetts Military Reservation Impact Area Groundwater Study Program

Innovative Technology Evaluation Program (ITE)

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Who's on the ITE Team ?

Army National Guard

AMEC Earth and Environmental

Technology Vendors (Subcontractors to AMEC)

Army Environmental Center

Waste-Management Education & Research Consortium

Army Corps of Engineers - New England District

US Environmental Protection Agency - Region I

Massachusetts Department of Environmental Protection

Strategic Environmental Research & Development Program

What is the ITE doing ?

- Review of innovative remediation technologies
- Selection of technologies that may be effective at MMR
- Laboratory bench scale testing to evaluate effectiveness
- Field scale demonstrations to test in real world application



Why is ITE being done ?

- Remediation of explosives in soil and groundwater at MMR
- Supporting responses to Administrative Orders
- Future applications at other DoD/NGB training installations



How ITE gets done!

- Team evaluation and consensus building to select technologies for laboratory treatability studies
- Internal and external QA/QC of team work products
- Successful technologies to be advanced for field demonstration



Physical Process - Soil Washing

Isolates and removes not only metal particulates from soil, but also the parts of soil with the most contaminants, thereby reducing the volume of soil requiring more advanced treatment



Photo courtesy of Brice, Inc..

Physical Process-Thermal Desorption

Thermal Desorption slowly heats soil, like in an electric oven at home -- Contaminants thermally degrade or volatilize (evaporate) and are safely removed from under a sealed cover

Thermal Desorption in the Field



Photo courtesy of TerraTherm, Inc.

Biological Process - Bioslurry

Bioslurry uses a wet environment (70 to 80% water) and adds a nutrient, such as molasses, to the soil

Laboratory test set-up for bioslurry



Photo courtesy of Envirogen, Inc.

Biological Process - Bioslurry

Molasses added to bioslurry

Molasses helps native micro-organisms grow and eat contaminants



Photo courtesy of Envirogen, Inc.

Biological Process - Solid Phase Bioremediation

Solid phase bioremediation uses a proprietary additive made from plant fibers



Photo courtesy of Grace Canada, Inc.

Biological Process - Solid Phase Bioremediation

With the proprietary additive as a nutrient, solid phase bioremediation helps native micro-organisms grow and eat contaminants

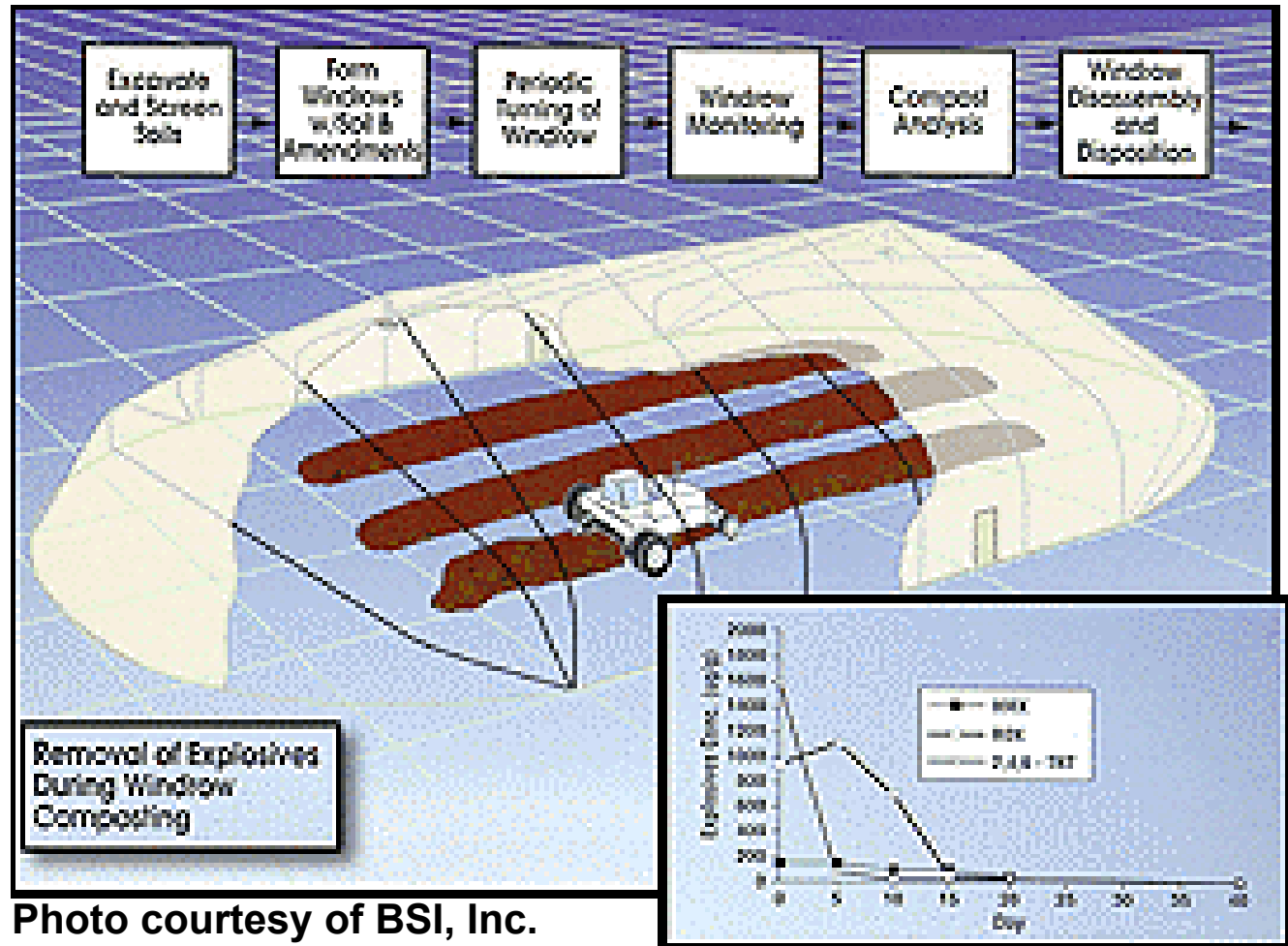


Photo courtesy of Grace Canada, Inc.

Biological Process - Composting

Conceptual View of Composting

Composting is similar to composting in your back yard, but on a bigger scale



Biological Process - Composting

Cranberry Mash used in lab studies

Composting uses locally available nutrients, such as cranberry mash, and bulking agents, such as wood chips



Biological Process - Composting

With added nutrients, composting helps native micro-organisms grow and eat contaminants

Composting in the field



Photo courtesy of BSI, Inc.

Chemical Process - Oxidation

Uses familiar chemicals such as hydrogen peroxide to destroy contaminants. Hydrogen peroxide breaks down to hydrogen and water.



Chemical Process - Reduction

Chemical Reduction in the Field

Chemical Reduction uses materials such as iron filings to destroy contaminants

Iron and additional amendments are mixed into windrows. Moisture is added to 35 – 40%



Photo courtesy of Brice, Inc. and University of Nebraska, Lincoln

Groundwater Remediation Technologies Slated for Study

- **Chemical oxidation: in-situ**
 - Uses oxidants such as hydrogen peroxide or permanganate
 - Injected directly into the groundwater
 - Quickly degrades contaminants via chemical oxidation
- **Redox manipulation: in-situ**
 - Uses easily degraded nutrient such as molasses, or a milk product
 - Injected directly into the groundwater
 - Enhances growth of naturally occurring micro-organisms, which then eat the contaminants as well as the nutrients



Innovative Technology Evaluation Schedule

- **Soil Treatability Studies**
 - Soil Washing complete - After optimization, reduction in volume of 74%
 - Bioslurry, composting, solid phase bioremediation, thermal desorption/destruction, chemical oxidation, chemical reduction still in process
- **Groundwater Treatability Studies**
 - Chemical oxidation and redox manipulation started April 2001

